ACEI ASSOCIATION OF CONSULTING ENGINEERS OF IRELAND

ACEI Design Excellence Awards 2018
Nomination Form

Category (1) Bridges
Category (2) Other Civil Projects
Category (3) Innovation Project (all disciplines)
Category (4) Overseas Project (all disciplines)

Company Details

Contact Name: Christy O'Sullivan

Firm: RPS

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Tel: 086 820 6087 **Email:** christy.osullivan@rpsgroup.com

Categories/Groups:

Project Category: Bridges ☐ **Other Civil Projects** ☐ **Innovation** ☐ **Overseas** ☒

Project Group:
SMALL Project (under €2.5m) ☐ **MEDIUM Project** (€2.5m - €10m) ☐ **LARGE Project** (over €10m) ☒

Project Information:

Name of Project: M8 / M73 / M74 Motorway Improvements Project

Location: Scotland

Commencement date: May 2012 **Completion Date:** Spring 2017

Client: Ferrovial Agroman / Lagan JV

Contact: María Del Mar Delgado (m.delgado@m8fl.com) Tel: +44 (0)7570 207 890

Design Team:

Architect N/A

Contact Email: _____ Tel: _____

Contractor Amey

Contact Gordon Allan Email: gordon.allan@amey.co.uk Tel: +44 (0)7899 058 402

Authorisation to contact above: **Yes** ☒ **No** ☐

ACEI ASSOCIATION OF CONSULTING ENGINEERS OF IRELAND

Project Details:

(1) Provide a brief outline of the project (Max 200 words):
See below

(2) Provide a statement regarding why this project might be considered award winning: (Max 300 words):
See below

(3) Provide further details of the project such as: design elements / procedures; complexities involved; innovation aspects; site management and supervision; health & safety issues; project cost controls and any other relevant information (Max 500 words):
See below

Entries should highlight where possible the particular influence or benefit the project engineering design has on society and the wider environment.

Please confirm by electronic or written signature that:

(a) The supplied text may be used in any marketing material issued in connection with the awards.

(b) Agreement has been received from the client and other stakeholders that the project can be inspected by the adjudicator and provide contact details as requested above for the relevant person to be contacted in this regard.

Signed: _____ _____

Firm: **RPS**

Entry details:

Note: Applicants are encouraged to review the Awards Regulations and Procedures before submitting nominations.

Send the completed entry form and supporting photos / images altogether in **one PDF document** (one pdf document per project nomination) by email to: info@acei.ie with a subject line:
ACEI Design Awards 2018.

Note: Closing date for receipt of nomination forms: **17:00, Friday 12th January 2018**

Enquiries: ACEI office info@acei.ie 01 6425588

M8 / M73 / M74 MOTORWAY IMPROVEMENTS PROJECT – OVERVIEW

The M8 / M73 / M74 Motorway Improvements Project upgrades the core of Scotland's motorway network. By improving connection times between Glasgow and Edinburgh, it will boost Scotland's economy, as well as reducing emissions and improving road safety. RPS acted as the contractor's designer (to Ferrovial-Lagan) on behalf of Transport Scotland for this major £500m DBFO project.

The project comprises a new three-lane motorway between Baillieston and Newhouse to complete the M8, upgrades to the M73 and M74, and upgrading one of Scotland's busiest junctions – the Raith Interchange.

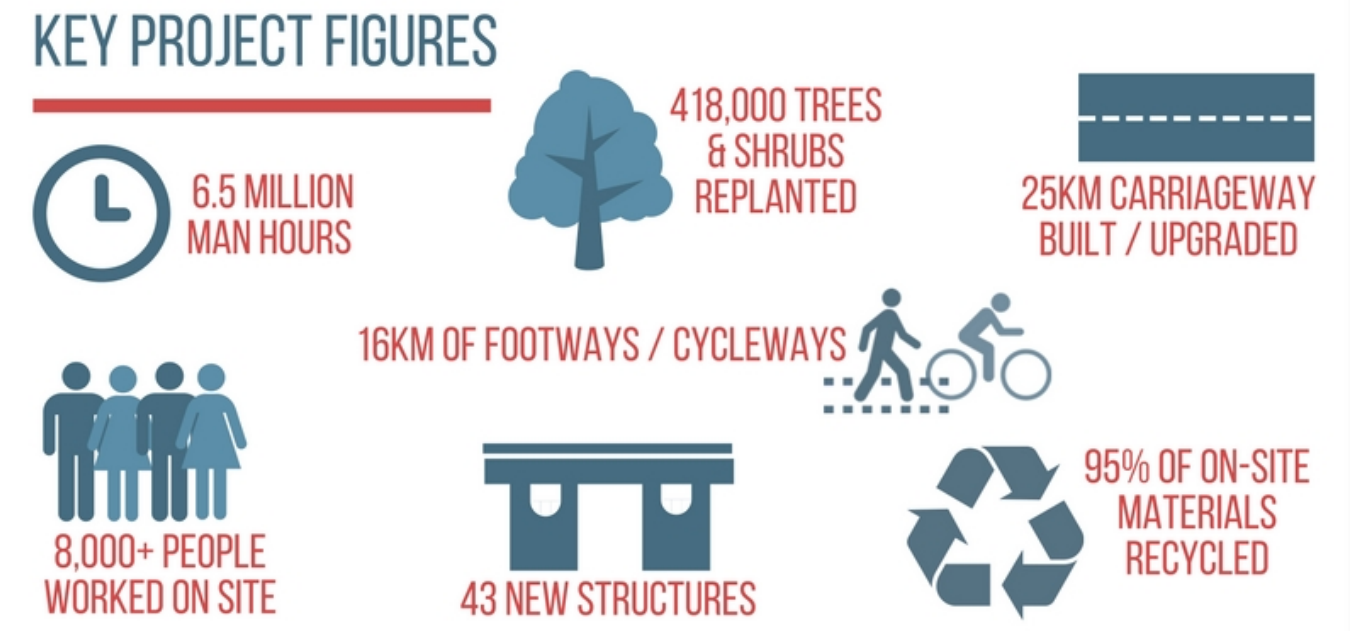
RPS faced a unique engineering challenge at this complex interchange, which required upgrading within a very confined footprint, under live traffic conditions with over 100,000 vehicle movements per day. We designed a new elevated free-flow rotary above the existing roundabout and an underpass beneath it – all in a flood plain, adjacent to an area of environmental sensitivity, coupled with massive artesian pressures and variable ground conditions.

RPS engaged all participants in a fully collaborative BIM partnership and integrated supply chain to optimise design, minimise costs and deliver the project on time. We used 3D modelling to drive integration, scheduling and provide a whole-life asset management tool.

Key Project Information:

Client: Transport Scotland
Project Value: Stg£500 million
Contract Type: DBFO
Project Status: Complete Spring 2017

Contractor: Ferrovial Agroman / Lagan JV
Operator: Amey
Contractor's Designer: RPS



EXEMPLAR PROJECT

RPS undertook detailed design of highways, bridges, other highway structures, geotechnical and lighting. We pioneered the use of building information modelling (BIM) technology on this project, achieving the first largescale implementation of Level 2 BIM on an infrastructural project in Ireland or the UK. The innovative project is an Exemplar Project for the definition of the Scottish BIM Mandate.

This innovative and collaborative approach facilitated successful delivery of the complex Raith Interchange. The unique engineering challenge was to replace the existing two-level junction with a three-level junction by constructing the new roundabout on top of the existing alignment while the junction remained open to traffic. Traffic congestion was an enormous project risk for Transport Scotland and RPS used Level 2 BIM to manage this risk. Detailed visualisations of temporary traffic management in 3D and 4D were indispensable. They provided understanding in real-time of the design proposals and facilitated effective communication with local authorities and engagement with stakeholders.

> **“ The use of Building Information Modelling (BIM) has been beneficial to us as a client organisation in understanding the benefits of the 3D model of the new Raith Junction… Transport Scotland fully endorses the work of Ferrovial-Lagan / Amey / RPS in bringing the benefits of BIM to the project ”**
>
> Graeme Reid, Project Sponsor, Transport Scotland

The location of the Raith Interchange in the Clyde floodplain presented design challenges. Earthworks for the underpass included a propped secant pile cutting (600m long and 15m deep) in loose sands and gravels under artesian conditions, which required complex temporary works design and dewatering. The underpass presented significant flotation problems requiring an array of ground anchors secured into bedrock.

The M8/M73/M74 footprint is extremely tight and covers an area of dense historic mine workings, with a multitude of shafts and adits that posed a significant risk during construction. RPS undertook a detailed study of the available geotechnical information and implemented a programme of remediation prior to construction. This involved extensive cavity probing and consolidation grouting.

PROJECT DETAILS

design elements & procedures | complexities | innovation | stakeholders site management & supervision | health & safety | project cost controls

A key design challenge was preventing floatation of the Raith underpass due to high artesian pressures and a flood level of up to 7m above the base of the underpass. This required detailed and complex 3D hydrogeological modelling to ascertain the likely impact of excavation works on the water table and determine the dewatering requirements. This was necessary to enable construction works and ensure stabilisation of the excavation base in the long term, through active dewatering of a deep rock aquifer, supplemented by the conversion of wells into a permanent aquifer depressurisation system.

With the project located within a flood plain, detailed drainage design provided for a Sustainable Urban Drainage System (SUDS), with ponds designed to cater for the 1 in 100-year storm plus climate change. The design included a pumping station with rising main to facilitate a 30-year storm event and road alignments were set to levels above the 200-year flood event where feasible. We provided off-line storage facilities for floodwaters to ensure no negative impact to flood risk.

Earthworks included a 600m long propped secant pile cutting requiring excavations up to 15m deep in loose sand and gravel. RPS designed an anchored solution to optimise pile diameters and toe depths, and to control lateral wall deflections while increasing durability performance. The design specification included testing regimes prior to excavation to ensure safety during construction. We specified and supervised materials testing for three road bridges, two pedestrian bridges and three culverts. We undertook structural inspections of two existing bridges, using linear elastic finite element modelling to inform the detailed structural design at the existing bridge piers.

The RPS "virtual" BIM model enabled detection and mitigation of a number of health and safety issues prior to construction.

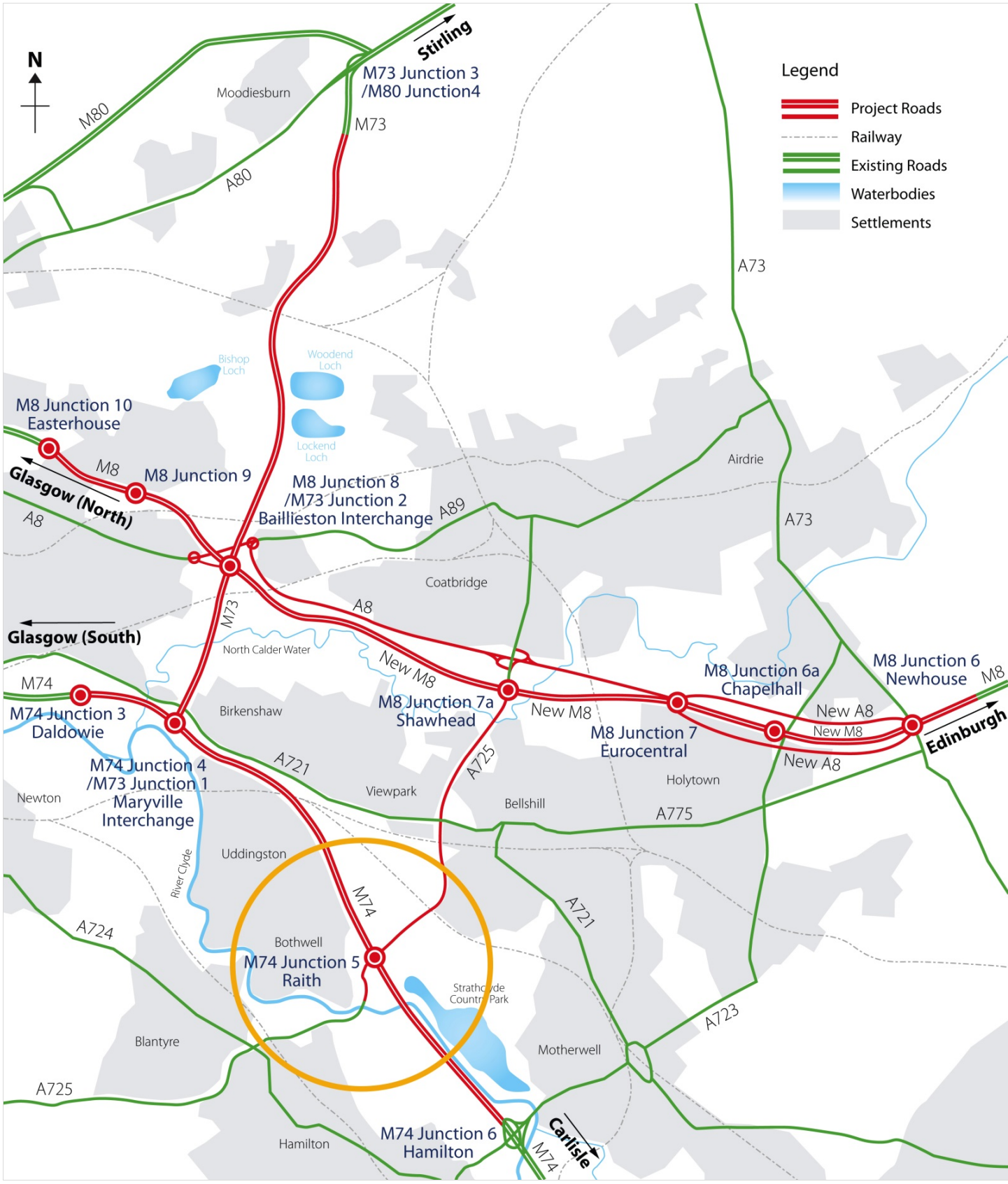
> **"The M8 M73 M74 Project is leading the way in its innovative approach to embrace BIM technology, which will dramatically improve the way the construction industry delivers infrastructure projects in the future."**
>
> Gabriel Valtueña-Ramos, General Manager, Scottish Roads Partnership

RPS also worked with pavement designers to develop a cost effective pavement foundation based on optimum use of the available materials on site.

RPS incorporated extensive ecological commitments into the detailed design e.g. to protect the valuable wetland habitat around Raith Junction. Working within a very restricted environment, we implemented suitable and practical mitigation measures including mammal tunnels, fences and bridges for movement of local wildlife. Noise attenuation barriers restrict the impact of the upgraded motorway project on local communities. These communities will also benefit from the 16km of additional walkways and cycleways included in the project – as well as reduced congestion, reduced air pollution and shorter, safer road journeys.

This design team of civil, structural and traffic management engineers, hydro-geologists and environmental scientists have worked collaboratively to achieve the optimum solution on this complex project – for the funding authority, the local communities and the environment.

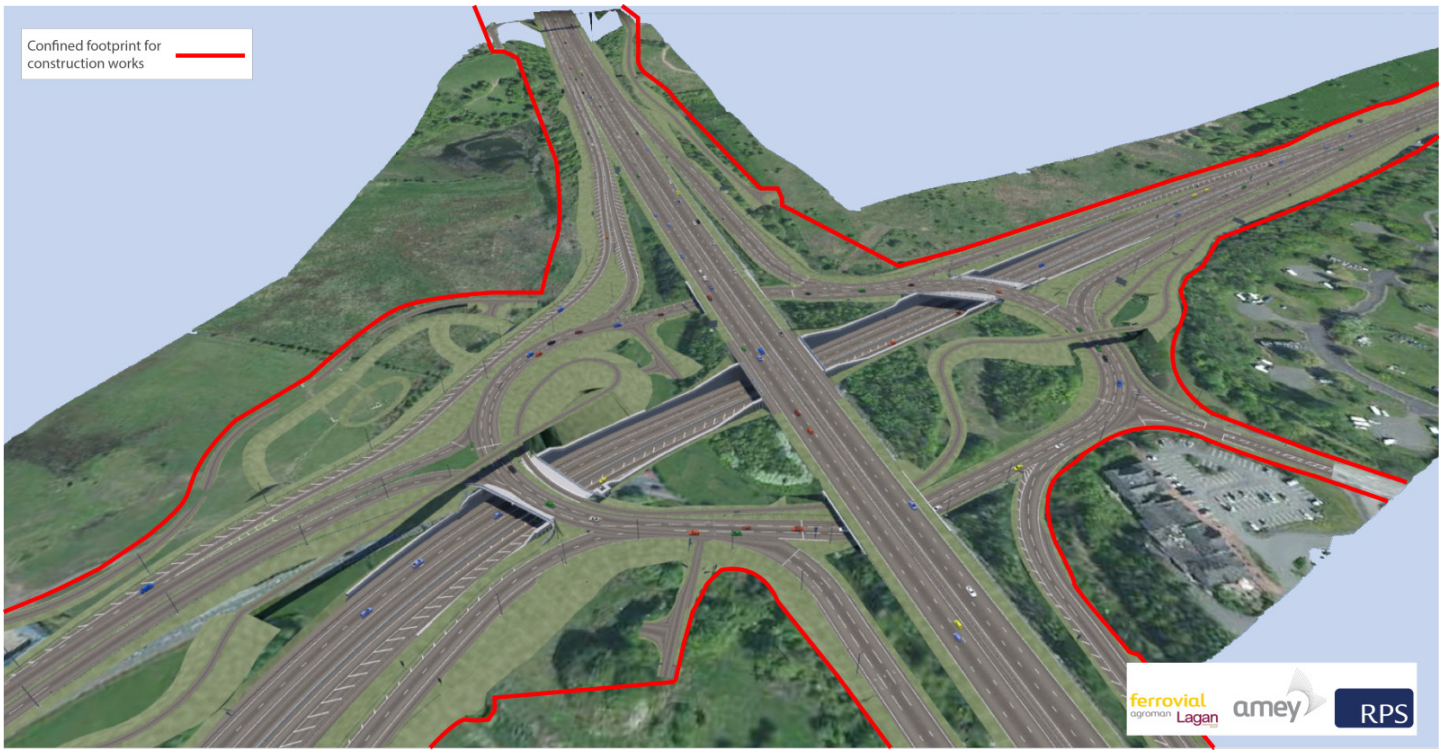
Project Images



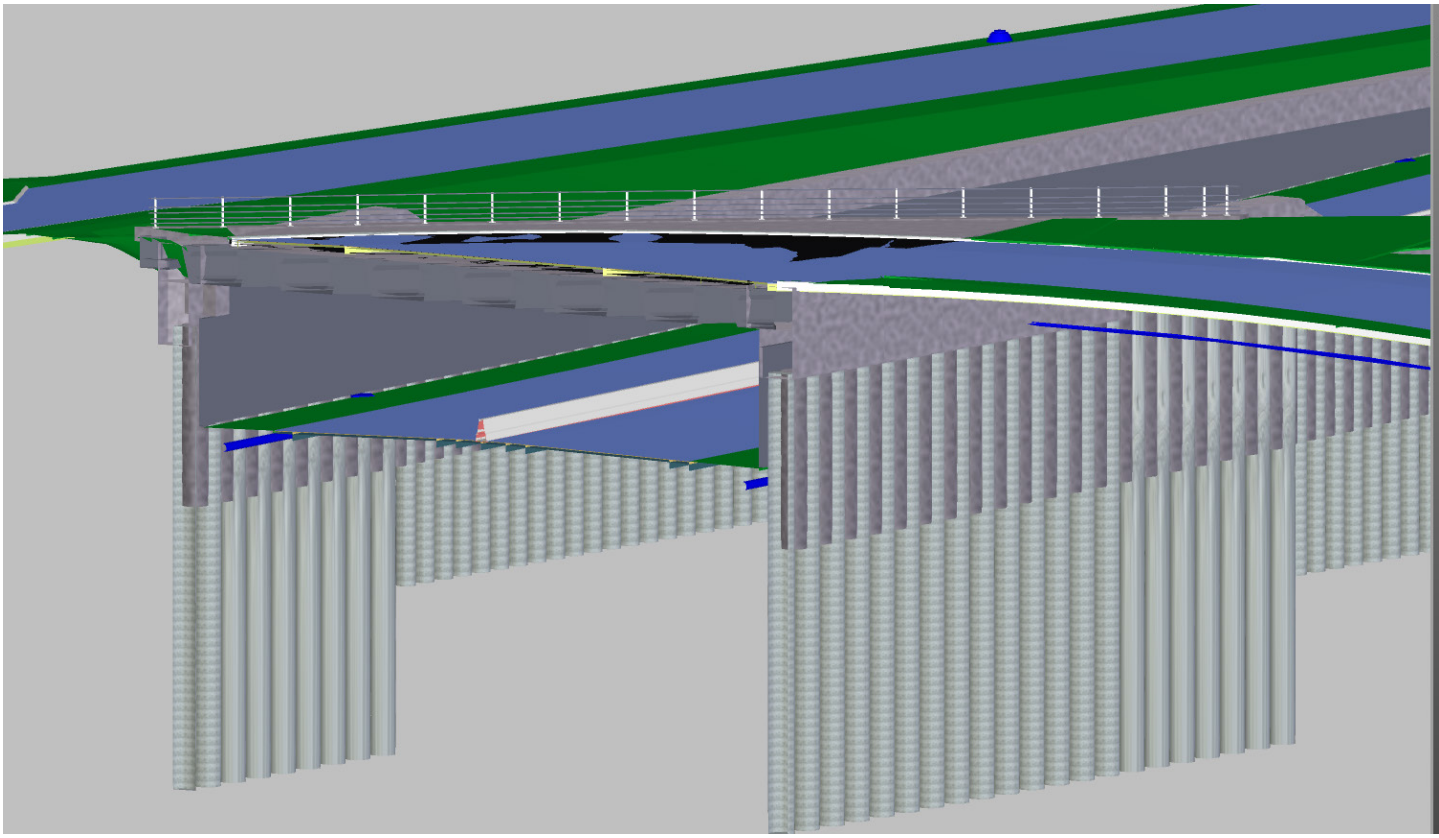
M8 M73 M74 Project Map (Transport Scotland)

M8 M73 M74 – Raith Interchange Open to Traffic (Spring 2017)

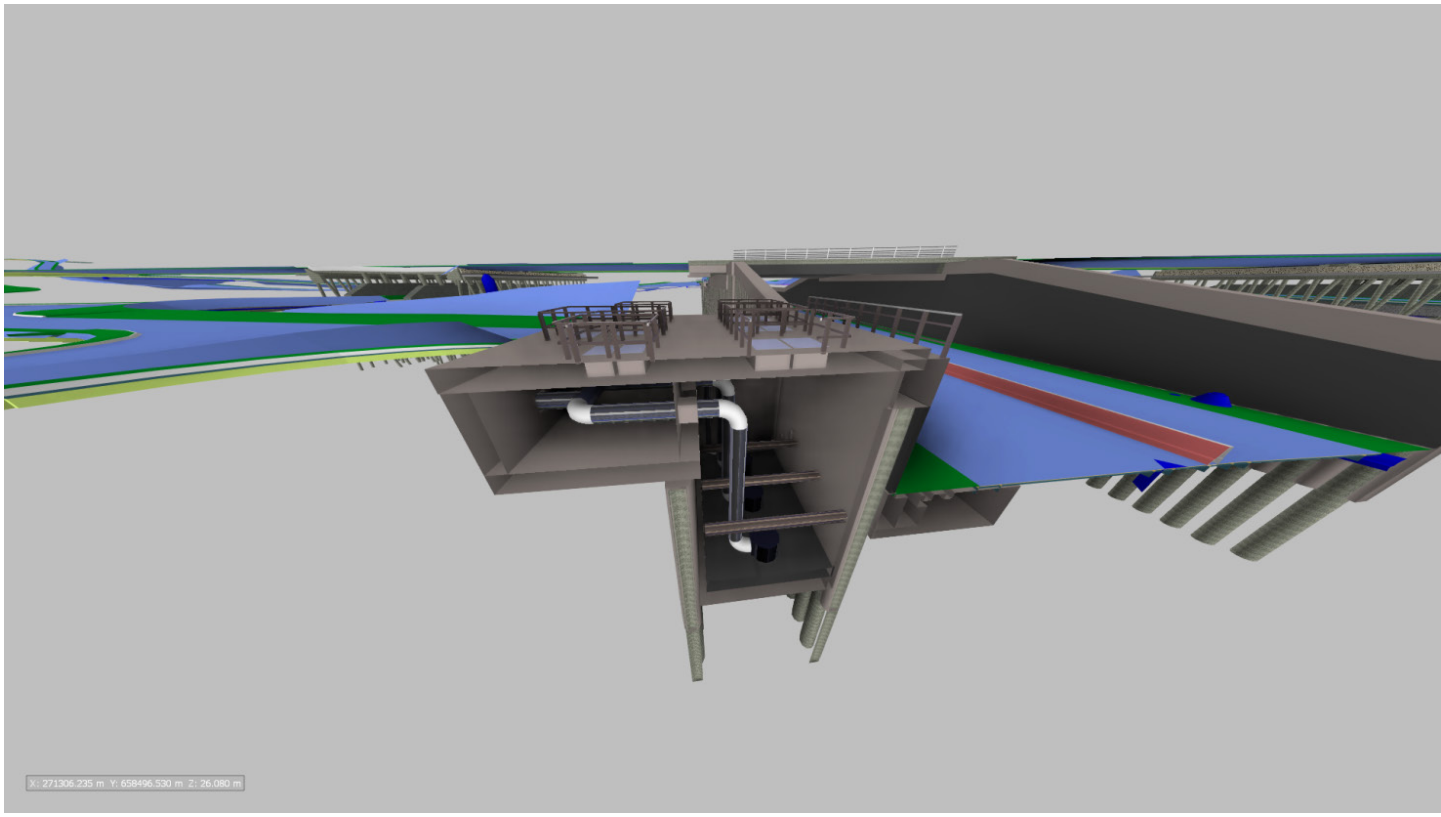
M8 M73 M74 – Raith Interchange (June 2017)



Raith Interchange (BIM Model) – Confined Footprint for Construction Works



Geotechnical Design – Raith Underpass



Road Drainage Pumping Station – Raith Underpass